

AN ECHINOID FROM THE LOWER CARBONIFEROUS OF NORTH-WEST AUSTRALIA

By G. A. THOMAS

Geology Department, University of Melbourne

Abstract

The first Carboniferous echinoid from Australia is described from the Septimus Limestone at Mt Septimus, Bonaparte Gulf Basin, Western Australia. The single specimen is an incomplete palaechinid probably referable to *Oligoporus* Meek & Worthen. Palaechinids are otherwise known from Western Europe, Russia, North America, and China.

Introduction

As far as known, no other Carboniferous echinoids have been described from Australia; Jones (1958, p. 37) has recorded echinoid spines and tubercles from bore cuttings at Laurel Downs in the Fitzroy Basin. The specimen was collected by the writer in September 1963 while visiting a field party of the Commonwealth Bureau of Mineral Resources, Geology and Geophysics. Echinoids are very rare in Australian Palaeozoic rocks; rare Permian (originally 'Permo-Carboniferous') species from New South Wales and Queensland were recorded by Etheridge in 1892. The new specimen is evidently a melonechinoid and appears to be referable to *Oligoporus* Meek & Worthen. The melonechinoids are an interesting and rather well known group of Palaeozoic echinoids. Best known from the Mississippian of North America and the Lower Carboniferous of Europe, they comprise two families: the very rare Cravenechinidae Hawkins and the Palaechinidae McCoy.

The latter family includes 5 genera: *Palaechinus* McCoy, *Maccoya* Pomel, *Lovenechinus* Jackson, *Oligoporus* Meek & Worthen, and *Melonechinus* Meek & Worthen. Mortensen (1935, following Jackson 1912) recorded all genera as possessing rigid high spheroidal or elliptical tests with two or more columns of plates in the ambulacra and four or more columns (exceptionally three) in the interambulacra. The tubercles are imperforate, small and uniform in size; the spines are small and uniform. The 5 genera, in the order listed, display a progressive complication of the ambulacral plates. The number of columns of plates and the number of series of pore-pairs show a progressive increase. Thus, the ambulacra of *Palaechinus* consist of two columns of primary plates with a regular single series of pore-pairs on each side. The pore-pairs are biserial on each side in *Maccoya* and *Lovenechinus*, triserial in *Oligoporus*, and multiserial in *Melonechinus* (up to six series on each side). The ambulacral features are best developed at the ambitus or mid-zone. Towards either pole the ambulacra are simpler and resemble the ambital structures of the more primitive genera. Generic subdivision is based on the complexity of the ambulacral structure. Mortensen (1935, p. 36) wrote: 'the limits of the genera may be regarded as in some way artificial; the passage from the simpler type of ambulacral structure to the more complicated types is very gradual, the divers genera clearly representing an unbroken direct ascending line'. Mortensen's presentation of the available data showed that the successive morphological stages followed in stratigraphic succession in the Mississippian but that the temporal succession appeared to be somewhat ambiguous for Europe. Kier (1965, p. 463) stated, however, that the stratigraphic occurrence

of most of these echinoids has never been defined more precisely than 'Early Mississippian'.

The palaechinids can attain considerable size; a species of *Melonechinus* is recorded as 15.5 cm in diameter at the ambitus and 11.5 cm in height.

Durham & Melville (1957) substituted *Palaechinoida* Haeckel for *Melonechinoida* Mortensen but this usage has not been followed here.

Systematic Description

Order MELONECHINOIDA Mortensen 1935

Family PALAECHINIDAE McCoy 1849

Genus *Oligoporus* Meek and Worthen

Type species *Oligoporus danae* (Meek & Worthen)

Oligoporus (?) sp.

(Pl. 25, fig. 1, 2)

DESCRIPTION: The unique specimen (Melb. Uni. Geol. Dept No. 3600) is rather coarsely silicified; it is partly embedded in fine-grained calcareous sandstone. Portions of two interambulacra and an ambulacrum are present. Although the polar plates are obscured, it is probable that the specimen is from the adapical surface of the corona. The convergence of the columns suggests that the specimen is from the vicinity of the apical disc rather than the peristome. The figures of various palaechinids illustrated by Jackson (1912) indicate that the peristome is considerably wider than the apical disc. There appears not to be sufficient space in the specimen, if it is from a mature individual, for a full-size peristome. The incomplete interambulacra show four columns of plates, the adambulacral plates being pentagonal and the median hexagonal. The sutures of the median plates are simple and vertical, while the adradial sutures bevel under the ambulacral plates. The surface of the plates is now finely granular, the result in part of silicification, but some of the granules are probably fine tubercles. No coarse tubercles are present. The largest median interambulacral plates are about 2 mm thick.

The incomplete ambulacrum is not well preserved and the details of the columns of plates are obscured by the coarse silicification. There appear to be four main columns though only the median and marginal sutures are distinct. The pore-pairs can be made out in part, the marginal series being the most obvious. There are certainly two series of pore-pairs in each half of the ambulacrum and the slight suggestion of a third series of more scattered pores. The details of the demi, isolated (if any), and occluded columns of plates cannot be distinguished. Transversely, both the ambulacrum and inter-ambulacra are convex (with different curvatures) indicating that the complete specimen had the melon-like meridional ribs, radiating from apical disc to peristome, characteristic of *Lovenechinus*, *Oligoporus*, and *Melonechinus*. The size of the complete individual is not known.

REMARKS: Although incomplete, the specimen displays a number of the diagnostic features of the Palaechinidae. Thus, it possesses the thick finely tuberculate interambulacral plates in at least four columns, there being undoubtedly more columns at the ambitus. The adradial sutures of the adambulacral plates bevel under the ambulacrum. The pore-pairs occur in two series and just possibly three on each side of the ambulacrum. *Maccoya* and *Lovenechinus* both possess two series of pore-pairs at the mid-zone but only one at the ends of the ambulacra. The series are more widely separated in *Lovenechinus* which possesses four columns of plates at the mid-zone (Fig. 1A). In our specimen the columns of

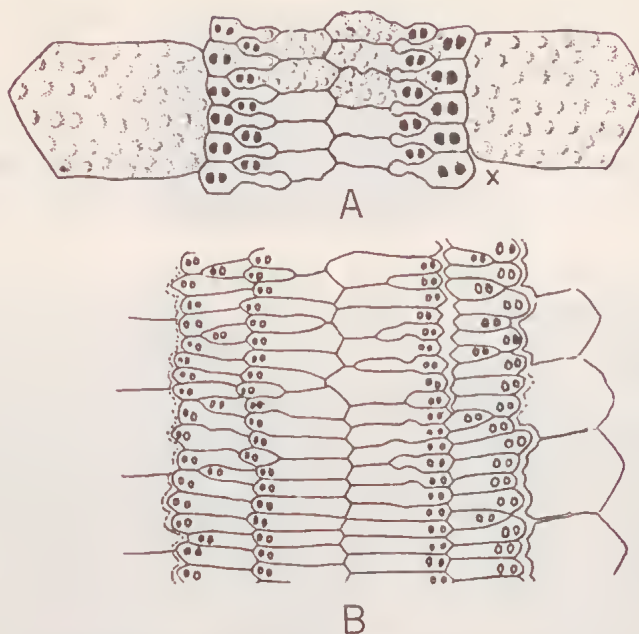


FIG. 1—A. *Lovenechinus missouriensis* (Jackson), type species of *Lovenechinus*. After Jackson (1912, Pl. 42, fig. 2, $\times 3.3$). Ambulacrum near the mid-zone, showing four columns of demi- and occluded plates and biserial pore-pairs. Also shows adambulacral plates with tubercles.

B. *Oligoporus danae* (Meek & Worthen), type species of *Oligoporus*. After Jackson (1912, Pl. 50, fig. 7, $\times 2.4$). Ambulacrum near the mid-zone, showing columns of demi- and occluded plates and scattered isolated plates. Pore-pairs are triserial.

plates are obscured but the two main series of pore-pairs are fairly widely separated as in *Lovenechinus* and *Oligoporus* (Fig. 1A, B). The third series of pore-pairs, if certainly present, could indicate either *Oligoporus* or *Melonechinus*. Unfortunately, the structure at the ambitus, where maximum development occurs, is not known. In *Oligoporus danae* Meek & Worthen, the scattered third series of pore-pairs which is present at the mid-zone fails towards the ends of the ambulaera and the structure becomes similar to that of *Lovenechinus* at the mid-zone. *Melonechinus* can probably be excluded as there is only slight indication of three series of pore-pairs and certainly there are no more on each side. Also, in *Melonechinus*, the melon-like ribs formed by the ambulaera tend to be wider and arched up in the middle. On balance, the specimen seems best referred provisionally to *Oligoporus*. Although agreeing in general with the known species of *Oligoporus*, the specimen does differ slightly from previously described forms. However, as it is incomplete and the size and variability cannot be determined, it is not named as a new species. Mortensen (1935) and Jackson (1912) have recorded 5 species of *Oligoporus*, all from the Mississippian of North America, ranging from the Keokuk to the St Louis (Upper Osagean to Meramecian). *Lovenechinus* is represented by 3 species in the Lower Carboniferous of Western Europe and 5 in the Mississippian of North America (Middle Osagean to Lower Meramecian). The other palaechinid genera have been described from the Mississippian, and from the Lower Carboniferous of Ireland, Britain, Belgium, France, Germany, Russia, and China.

OCCURRENCE: About 200 ft below top of Septimus Limestone, on NE. slope of Mt Septimus, Bonaparte Gulf Basin, NW. Australia. A general locality map appears in Thomas (1965, Fig. 1).

ASSOCIATED FAUNAS AND AGE: The Septimus Limestone, approximately 600 ft thick, contains a varied fauna of brachiopods, rugose and tabulate corals, bryozoans, crinoids, rare blastoids—cf. *Pentremites*, pelecypods and gasteropods, ostracods and conodonts. The brachiopods are generally the most common fossils, and the assemblage is of normal mixed neritic type. Silicification is widespread throughout the formation.

The age of the faunas is discussed in Thomas (1962, 1965). The brachiopods suggest an Early Visean age. The known range of *Oligoporus* from Osagean to Meramecian, which are equivalent to part of the Visean, is consistent with the brachiopod evidence.

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Explanation of Plate

PLATE 25

- Fig. 1—*Oligoporus* (?) sp. MUGD 3600, $\times 1$. Septimus Limestone, Mt Septimus, Bonaparte Gulf Basin, NW. Australia.
- Fig. 2—*Oligoporus* (?) sp. Same specimen, $\times 4.4$, showing portions of an ambulacrum and two interambulacra.